A PETROGRAPHIC STUDY OF METASEDIMENTARY AND METAVOLCANIC ROCKS IN THE SOUTHWESTERN PART OF THE CLAYVILLE QUADRANGLE, RHODE ISLAND

By

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INTRODUCTION

The Clayville Quadrangle, in Providence County, is in northwestern Rhode Island. A more specific location is 41°45' to 41°52'30" north latitude and 71°31'30" to 71°45' west longitude. The rocks in this area range in age from Precambrian to Pennsylvania or younger. Eight major rock units are present in the Clayville area; these igneous and metamorphic rocks are part of Rhode Island's complex structural relations and variable lithology, and range from diorite intrusions to metavolcanics.

STRATIGRAPHY AND STRUCTURE

Blackstone Series

The Blackstone Series , a migmatite from the Precambrian (?) is widely exposed in the west central and northwestern parts of the Clayville Quadrangle (Quinn, 1971, p. 9,14). Rock of this type is primarily feldspar, quartz, biotite and muscovite. Foliation strikes northeasterly, the dip ranges from 30° northwest to 75° southwest, indicating a syncline. Originally these rocks were quartzite and biotite schist. The series may have been comparable to the Sneech Pond Schist and the Mussey Brook Schist before migmatization. Intrusions of granitic, aplitic, pegmatic material, and quartz in the forms of stringers, sills, dikes, and veins originated from the Ponaganset Gneiss. Contacts have been found to vary from gradational to sharp.

Light Colored Gneiss and Absalona Formation

A light colored gneiss and the Absalona Formation (Gneiss) are

considered to be part of the older gneissic rocks of northwestern Rhode Island. Some controversy exists as to the relations of these two gneisses to the Blackstone Series of Northeastern Rhode Island. Richmond (1952) states that the two gneisses are older than the Blackstone Series, which lies unconformably over the gneissic rocks. Unfortunently the unconformity he suggests is covered by glacial drift where it might otherwise be exposed. Current information does not accurately indicated the age of the two gneisses but Quinn (1971, p.15) indicates that they are quivalent to, or older than, the Blackstone Series. The gneisses may have formed as thick accumulations of graywacke, feldspathic sands, tuffs, and as ash flows and lava flows mostly of felsic composition. Estimated thickness of the gneisses is 5000 to 10000 feet or more. A complicated overturned anticline is the structure here. Foliation of the Absalona Formation strikes northwesterly and dips 20° to 75° to the northeast. Lineation is northwesterly to northeasterly and plunges 21°. The light colored gneiss has foliation striking in a northeasterly direction and averaging a dip of 31° to the northwest. Lineation bears northeasterly to northwesterly and plunges from 5° to 32°.

Metavolcanic and Metasedimentary Rocks

Metavolcanic and some metasedimentary rocks are irregularly exposed in the southwest corner of the Clayville Quadrangle. Harwood and Goldsmith (1971) have correlated these rocks with

the Precambrian Plainfield Formation. Dr. George E. Moore, Jr. (1963) associates these rocks with the Blackstone Series. Quinn (1971) believes that the Ordovician is the correct association. At the present time evidence is insufficient to resolve this problem. The majority are light gray to dark gray fine-to coarse-grained interlayered feldspathic gneiss, schist, quartzite, amphibolite, and limesilicate rocks. The dominanat minerals are feldspar, muscovite, biotite, quartz, and amphibole. This is the primary unit from which the samples described in this report were taken. Most of the metasediments have at least weakly developed foliation but not all show clear lineation. Potassium feldspar, if present, is a minor constituent of these particular specimens. It is not unusual to find zircon, apatite, sphene, and epidote as accessory minerals. For more information see the rock and thin section descriptions beginning on p. 8.

Metadiorite and Schistose Diorite

A large outcrop of metadiorite and schistose diorite from the Upper Ordovician occurs in the north. Foliation strikes northeasterly and dips 30° southeast but becomes vertical to the north. Lineation plunges 8° to the northeast. Evidence indicates that the majority of metadiorites here formed as diorite intrusives but some may have resulted from the metamorphism of sedimentary or volcanic rocks (Quinn, 1971, p. 24). These rocks vary from gray to dark gray and greenish, fine-to coarse-grained, and

are schistose and streaky to massive. Hornblende, plagioclase, quartz, biotite, epidote, and chlorite are the main minerals and it is common to find retrograde metamorphism has occurred.

Ponaganset Gneiss

The Paleozioc Ponaganset gneiss is the most extensively exposed formation in the Clayville Quadrangle. It is possible that the Northbridge Granite Gneiss of Massachusetts is the stratigraphic equivalent of the Ponaganset. In most places gneissic structure is steep and trends northward; lineation plunges northward; in some places a second foliation trends westward and dips gently northward (Quinn, 1971, p.24). This rock can be fine, medium, or coarse-grained and even porphyroblastic. Most appears light gray but some is pinkish-or dark-gray. Major constituents are plagioclase, potassium feldspar, quartz, and biotite, while hornblende and muscovite have been found in minor amounts. The contact between the Ponaganset and the Blackstone Series (Quinn, 1967) proves that the Blackstone is the older of the two. The Ponaganset came in as a liquid or partially liquid material that pushed Blackstone schist and quartzite aside and rotated blocks within this liquid. This evidence suggests that a mass of sedimentary rock, most likely graywacke or other feldspathic sediments, was heated until it intruded higher rocks as a liquid or partial liquid. (These higher rocks were also intruded by water-rich solutions.) These events are due to considerable stress and syntectonic stresses applied to these particular rocks (Quinn, 1971, p.25). The Ponaganset is a major source of the specimens in this study. For further

information see p. 8 , rock and thin section reports.

Scituate Granite Gneiss

Grouped with other memebers of some older plutonic rocks is the Scituate Granite Gneiss. The more highly developed foliation in the Ponaganset indicates that the Scituate may be younger. The Scituate is pink, tan, or gray; medium-to coarse-grained and usually contains splotches of biotite that express a lineation. Local occurence of foliation is not unusual. Major constituents are microcline, microperthite, albite-oligoclase, smoky quartz, and biotite. Hornblende and magnetite can be seen in some hand specimens. Outcrops in the North Scituate and Hope Valley Quadrangles suggest that the Scituate Gneiss is a magmatic intrusion which cuts the Blackstone Series and other rocks (Quinn, 1971, p.25).

Gabbro

Three different gabbros appear in Rhode Island and one of these extends a short distance into the Clayville Quadrangle. This gabbro is Pennsylvanian or younger because it has not been altered by regional metamorphism which did alter Pennsylvanian rocks in this area (Quinn, 1971, p. 31). Evidence suggests that this gabbro is an intrusive that cut through the surrounding metamorphic rocks. Most of these rocks are uniformly coase-grained, dark green to grayish purple, with platy crystals of grayish purple andesine-labradorite. Foliation may be well developed here as

a primary flow structure (Quinn, 1971, p.30). Augite, olivene, biotite, magnetite, and apatite are present as minor minerals.

SPECIMEN CL 16 A - QUARTZ DIORITE

Location	250 feet N.45°E. of the S.W. corner of the quadrangle at elevation 440 feet.
Megascopic	Fine-to coarse-grained white porphyritic quartz-biotite-feldspar quartz diorite. Phenocrysts of feldspar are 15 to 20% of rock. Biotite expresses moderately developed lineation.
Thin Section	Plagioclase shows moderate sericitization. Microcline contains anhedral quartz inclusions. Myrmekite forms less than 1% of total slide. Grains average 1.0mm.
Composition	
35% Plagioclase	Anhedral grains average 0.1mm to 0.25mm but are as large as 2.0mm. 3 to 4 distinct zones may be present in a grain. Twinning is very poorly developed.
30% Microcline	Grains range from 5.5mm to 0.5mm and are anhedral. Most are 2.5mm. Quartz inclusions are 0.25mm or less. Perthitic texture evident.
25% Quartz	Anhedral grains of 1.0mm to 2.0mm. Some grains present as inclusions in microcline and as constituent of mymekite with plagioclase. Undulose extinction moderately developed.
8% Biotite	Subhedral grains range from 0.25mm to 0.75mm. Characteristic birdseye effect seen near parallel extinction.
1% Chlorite	Grains range from 0.01mm to 0.25mm. All are anhedral.
1% Accessories	Muscovite, epidote, allanite.

SPECIMEN CL 16 B - GNEISS

Location	320 feet N.14.5°E. of the S.W. corner of the quadrangle. Also outcrops at 420 feet N.49 E. of the S.W. corner of the quadrangle at elevation 460 feet.
Megascopic	Fine-to coarse-grained gray biotite-quartz-plagioclase-sphene metasedimentary gneiss containing 2 to 3 percent metacrysts of plagioclase. Weak lineation shown by biotite. Rock weathers orange-brown.
Thin Section	Weak pleochroic haloes in biotite. Average grain size of plagioclase is 3.5mm; quartz, 0.75mm: biotite, 0.75mm. Sericite is weakly developed. Less than 1% of rock is myrmekite.
Composition	
60% Plagioclase	Anhedral grains ranging from 2.0mm to 5.0mm. Albite and Carlsbad twinning is moderately developed. Quartz inclusions present in some grains as myrmekite. Sericite on most grains.
25% Quartz	Grains range from 0.75mm to 0.5mm but most are 0.75mm, anhedral. Less than 1% of total quartz is inclusions.
13% Biotite	Weakly developed pleochroic hales. Anhedral to subhedral grains range from 0.25mm to 1.25mm but most is from 0.5mm to 1.0mm.
2% Accessories	Sphene, zircon, epidote, chlorite, apatite, allanite.

SPECIMEN CL 16 C - QUARTZ DIORITE

Location	720 feet N.6°E. of the S.W. corner of the quadrangle. 450 feet due E. of the Greenbush Road corner.
Megascopic	Fine-to coarse-grained gray biotite-quartz-feldspar quartz diorite. Rock weathers yellow. No lineation or foliation present.
Thin Section	Sericite is moderately developed on plagioclase grains and along grain boundaries. Grains average 0.75mm. Majority are anhedral. Sphene closely associated with biotite.
Composition	
48% Plagioclase	Anhedral grains range from 0.25mm to 7.25mm. Grains 0.25mm to 0.5mm are zoned with 2 to 4 zones. Grains larger than 0.5mm have well developed albite and/or Carlsbad twinning. Anhedral quartz inclusions measuring 0.25mm or less are present in 2% of all plagioclase.
27% Quartz	Moderately developed undulose extinction. Grains range from 0.75mm to 1.75mm. All are anhedral.
18% Microcline	Anhedral grains are 0.25mm to 1.75mm. Extinction is sharp. Most grains are not twinned. Polysynthetic twinning is extremely weak.
5% Biotite	Grains range from 0.25mm to 2.0mm. Most are 0.25mm to 0.5mm. Subhedral to anhedral. Zircon inclusions in most grains. Pleochroic in yellowish-brown to olive green.
1% Sphene	Occurs with biotite. Grains range from 0.5mm to 1.75mm.
1% Accessories	Chlorite, epidote, hematite, apatite, muscovite.

SPECIMEN CL 16 D - QUARTZ DIORITE

Location	1000 feet N.48°E. of the S.W. corner of the quadrangle at elevation 480 feet.
Megascopic	Fine-to medium-grained dark-gray biotite-quartz-feldspar-pyrite quartz diorite. This quartz diorite is a dike that cuts a medium gray feldspar-quartz-biotite gneiss. Pyrite is less than 1%. Slide is of quartz diorite only.
Thin Section	Unusually large percentages of spinel and epidote; each is 2%. Grains average 0.25mm. Euhedral to subhedral. Foliation and lineation are not present.
Composition	
30% Biotite	Grains range from 0.25mm to 0.75mm and are subhedral. No preferred orientation. Birdseye effect near parallel extinction. Majority of epidote occurs with biotite.
30% Quartz	Most grains are 0.1mm and less but may be as large as 0.25mm. Undulose extinction indicates that grains have been strained. Subhedral to anhedral.
25% Plagioclase	Weak zoning present in some grains. Sizes range from less than 0.1mm to 0.25mm. Albite and Carlsbad twins are poorly developed.
10% Microcline	Subhedral to anedral grains ranging from 0.1mm to 0.25mm. Twinning is poorly developed.
2% Edidote	Grains are less than 0.1mm and are subhedral to anhedral. Slightly pleochroic in light yellowish green. Closely associated with biotite.
2% Spinel	Euhedral to subhedral grains are 0.1mm and are 0.1mm and less. Octahedra are isotropic under crossed polars.
1% Accessories	Pyrite(surrounded by limonite), magnetite.

SPECIMEN CL 17 B - QUARTZ DIORITE

Location	1580 feet N.23°E. of the S.W. corner of the quadrangle at 520 feet elevation.
Megascopic	Medium-to coarse-grained gray porphyritic quartz-biotite-feldspar quartz diorite. Feldspar phenocrysts are 10-15% of total composition. Well developed fractures are present. Rock weathers to yellow. Foliation
Thin Section	Grains average 0.75mm. Moderate sericitization on plagioclase. Quartz is dominant mineral along fractures. Grains are euhedral to subhedral.
Composition	
44% Andesine	Zoned grains are 0.1mm or less and have 2 to 3 zones. Grains larger than 0.1mm are well twinned. Phenocrysts ranging from 2.0mm to 7.5mm have moderately developed sericite. Myrmekite is 1-2% of total slide. Anhedral grains.
30% Quartz	Anhedral grains ranging from 0.25mm to 2.5mm but most are 0.75mm. Strain effects shown by moderately developed undulose extinction.
20% Microcline	Anhedral grains ranging from 1.5mm to 3.75mm. Tartan twinning well developed. Anhedral quartz inclusions are 0.5mm to 0.1mm.
5% Biotite	Euhedral to anhedral grains range from 0.25mm to 1.1mm. Very weak pleochroic haloes have developed around zicon inclusions. Epidote closely associated with biotite..
1% Accessories	Muscovite, chlorite, epidote, sphene, apatite, magnetite.

SPECIMEN CL 17 C - GNEISS

Location	1560 feet N.45°E. of the S.W. corner of the quadrangle at elevation 500 to 510 feet.
Megascopic	Medium-to coarse-grained quartz-biotite-plagioclase gneiss. Rock weathers yellow. Weak foliation is shown by alternating layers rich in biotite and feldspar. Lineation suggested by biotite.
Thin Section	Average grains of biotite are 0.75mm; plagioclase, 1.5mm; quartz, 1.0mm; potassium feldspar, 1.5mm. Light sericitization on plagioclase. Lineation is very weakly developed. Epidote is closely associated with plagioclase.
Composition	
59% Plagioclase	Grains range from 0.5mm to 5.0mm but most are 0.75mm and subhedral. Anhedral grains less than 0.5mm are zoned with 2 to 3 zones.
20% Biotite	Subhedral to anhedral grains average 0.75mm but range from 0.5mm to 2.0mm. Characteristic birdseye extinction. Pleochroic in yellowish-brown to olive green.
12% Quartz	Anhedral grains average 1.0mm. Very slight wavy extinction indicates minimal strain.
5% Potassium Feldspar	Anhedral grains range from 1.0mm to 2.0mm. No twinning apparent.
1% Accessories	Epidote, muscovite, apatite, allanite.

SPECIMEN CL 18 A - QUARTZ DIORITE

Location	1900 feet N.61°E. of the S.W. corner of the quadrangle. Elevation 490 feet.
Megascopic	Coarse-grained medium-gray quartz-biotite-feldspar quartz diorite. Phenocrysts of feldspar range from 20 to 30% of total feldspar. Rock weathers yellowish-brown.
Thin Section	Plagioclase has well developed twinning and moderate sericitization, Average plagioclase phenocryst is 3.25mm. Other grains average 1.0mm. A few weak pleochroic haloes are present with biotite.
Composition	
44% Andesine	Phenocrysts range from 2.25mm to 5.25mm, are 85% of plagioclase in the slide, and show well developed albite and Carlsbad twinning. Anhedral quartz inclusions of 0.25mm, or less, in some grains.
15% Potassium Feldspar	Grains are slightly cloudy. None to extremely weak twinning. Anhedral grains range from 0.5mm to 0.75mm, (Microcline?)
15% Biotite	Subhedral grains ranging from 0.25mm to 2.0mm but most are 0.5mm to 1.0mm. Weak pleochroic haloes have developed around zircon. Birdseye effect near parallel extinction.
10% Quartz	Grains are anhedral and range from 0.5mm to 1.0mm. Very weak strain effects are shown by undulose extinction.
1% Accessories	Epidote(closely associated with plagioclase), apatite, sphene, zircon.

SPECIMEN CL 18 B - GNEISS

Location	2240 feet N.79°E. of the S.W. corner of the quadrangle at elevation 510 feet.
Megascopic	Coarse-grained dark-gray quartz-feldspar-biotite gneiss. Foliation is moderately developed and is shown by successive layers rich in biotite and feldspar. Rock weathers yellow.
Thin Section	Grains average 1.0mm. Radiohaloes are moderately developed in biotite. Subhedral to anhedral. Plagioclase is well twinned. Lineation is weakly developed.
Composition	
60% Plagioclase	Subhedral to anhedral grains range from 0.75mm to 1.25mm. Albite and Carlsbad twins. Anhedral quartz inclusions range from 0.25mm to 0.1mm, or less, are present in some grains.
33% Biotite	Subhedral to anhedral grains. Many show characteristic birdseye texture. Grains range from 0.25mm to 1.75mm. Radiohaloes have developed around zircon inclusions.
5% Quartz	Grains range from 0.25mm to 1.0mm and are anhedral. Undulose extinction indicates strain has occurred.
2% Accessories	Epidote, allanite, apatite, zircon, pyrite, magnetite.

SPECIMEN CL 19 A - GNEISS INTRUDED BY QUARTZ DIORITE

Location	2050 feet N.52.3°E. of the S.W. corner of the quadrangle at elevation 517 feet.
Megascopic	Medium-to coarse-grained medium-to dark-gray biotite-plagioclase-quartz gneiss which has been intruded by a medium-grained medium-gray plagioclase-potassium feldspar-quartz-biotite quartz diorite. Weak foliation in gneiss. Rock weathers yellowish- brown.
Thin Section	Sericite is weakly developed in gneiss and quartz diorite. Lineation in gneiss is moderately developed but lineation in quartz diorite is poorly developed. Grains average 0.75mm in diorite, subhedral to anhedral. Grains average 0.25mm in gneiss, subhedral to anhedral.

Composition (Gneiss)

58% Plagioclase	Subhedral to anhedral grains. Size ranges from 0.5mm to 2.0mm but most is 1.0mm. Most grains that are 0.25mm to 0.5mm are zoned with 2 to 3 zones. Weakly developed albite and pericline twins are present in most grains larger that 0.25mm. Sericite grains are less than 0.1mm.
26% Quartz	Anhedral grains range from 0.25mm to 1.00mm. Undulose extinction is moderately developed in some grains and may not be present in all grains.
11% Biotite	Moderately developed radiohaloes around zircon inclusions. Orientation of grains shows lineation is moderately developed. Pleochroic in yellowish-brown to olive green.
5% Muscovite	Subhedral grains range from 0.25mm to 1.0mm. Birefringence is higher than biotite. Colorless in plain polarized light.
1% Accessories	Zicon, allanite, epidote, magnetite.

Composition (Quartz Diorite)

46% Plagioclase	Anhedral grains range from 0.75mm to 0.25mm. Fine grained sericite. Very weak albite and pericline twinning.

25% Microcline	Grains range from 0.25mm to 1.75mm. Many are anhedral. Polysynthetic twinning is moderately developed. Many grains display perthitic texture.
20% Quartz	Subhedral to anhedral grains. Size ranges from 0.15mm to 1.25mm. Undulose extinction is moderately developed in grains larger than 0.2mm. Grains .2mm or smaller may be subhedral with no undulose extinction.
5% Biotite	Subhedral grains range from 0.25mm to 0.75mm. Birdseye effect seen near parallel extinction. Pleochroic in yellowish-brown to olive green.
3% Muscovite	Occurs closely with biotite. Grains average 0.25mm. Subhedral to anhedral.
1% Accessories	Zircon, apatite.

SPECIMEN CL 19 B - QUARTZ DIORITE

Location	2500 feet N.45°E. of the S.W. corner of the quadrangle at elevation 538 feet.
Megascopic	Fine-to medium-grained light-gray plagioclase-quartz-biotite gneiss. Foliation is not well developed. Rock weathers yellow.
Thin Section	Sericite is moderately developed on plagioclase. Biotite shows that lineation is moderately developed. Subhedral to anhedral grains. Average grain size is 1.0mm.
Composition	
48% Plagioclase	Most are 1.25mm to 0.5mm but are as large as 2.0mm. Many are anhedral. Well developed albite, Carlsbad, and pericline twinning. A few grains are zoned with 2 to 4 zones. Sericite is fine-to coarse-grained.
20% Microcline	Grains are anhedral. Size ranges from 0.75mm to 0.5mm. Twinning is extremely poorly developed and may not be present.
17% Quartz	Undulose extinction is moderately developed. Grains range from 1.0mm to .25mm. All are anhedral.
10% Biotite	Yellowish-brown to brown pleochroism. Most grains are 0.75mm but range from 0.1mm to 1.0mm. Subhedral to anhedral. Moderately developed radiohaloes in a few grains. Near parallel extinction birdseye effect is seen.
3% Hornblende	Grains range from 0.75mm to 0.25mm, anhedral. Yellowish-green to bluish-green pleochroism. Moderately developed radiohaloes in a few grains.
2% Accessories	Epidote, sphene, apatite, hematite, allanite.

SPECIMEN CL 20 C - SCHIST

Location	1800 feet due north of the S.W. corner of the quadrangle at elevation 490 to 505 feet.
Megascopic	Fine-to coarse-grained medium-gray quartz-biotite— garnet-plagioclase schist. Foliation moderately developed, as shown by layers rich in biotite and feldspar. Weathers yellow-to yellowish-brown.
Thin Section	Grains are subhedral to anhedral. High percentage of staurolite is unusual. Average grain size of plagioclase is 0.25mm; quartz, 0.5mm; biotite, 0.75mm; staurolite, 3.0mm.
Composition	
61% Plagioclase	Anhedral grains range from 0.25mm to 0.50mm. Albite twins are moderately developed in a few grains. Many are zoned with 3 to 4 zones.
18% Biotite	Strong pleochroic haloes around zircon inclusions. Apatite inclusions are also present. Subhedral to anhedral grains. Size ranges from 0.1mm to 1.5mm.
15% Quartz	Undulose extinction is weakly to moderately developed. Grains range from 0.25mm to 1.0mm. Most are 0.5mm
3% Staurolite	Anhedral grains range from 1.0mm to 4.25mm. Quartz inclusions as large as 0.25mm. Yellow to colorless pleochroism.
1% Muscovite	Grains range from 0.1mm to 1.75mm but most are 0.75mm. Euhedral to subhedral. Birefringence is higher than biotite.
1% Accessories	Kyanite, apatite, zircon, chlorite, tourmaline.

SPECIMEN CL 20 E - QUARTZ DIORITE

Location	2600 feet N.14°E. of the S.W. corner of the quadrangle at elevation 560 feet.
Megascopic	Coarse-grained light-gray plagioclase-biotite-potassium feldspar-sphene porphyritic quartz diorite. Feldspar phenocrysts are 10% of total rock. Rock weathers yellow.
Thin Section	Phenocrysts of feldspar range from 2.25mm to 7.25mm. Weak sericitization on plagioclase and along grain boundaries. Sphene is at least 2% of total composition. Grains are subhedral to anhedral. Average grain size of plagioclaise is 1.25mm; quartz, 1.0mm; microcline, 3.0mm; biotite, 0.75mm; sphene, 1.75mm.
Composition	
39% Plagioclase	Moderate to well developed albite, pericline, Carlsbad twins. Subhedral to anhedral grains ranging from 0.5mm to 2,25mm. Vermicular quartz inclusions form myrmekite. Less than 1% of plagioclase is myrmekite.
35% Quartz	Grains ranging from 0.5mm to 2.5mm but most are 0.75mm to 1.0mm. All are anhedral.
16% Microcline	Polysynthetic twinning is moderately developed. Most grains are 2.5mm to 3.5mm but may be as large as 7.25mm. Subhedral to anhedral grains.
7% Biotite	Size ranges from 0.25mm to 1.25mm but the majority of grains are 0.5mm to 1.0mm. Moderately developed pleochroic haloes surrounding zircon inclusions. Subhedral to anhedral.
2% Sphene	Subhedral to anhedral grains. Maybe as large as 2.5mm but most are 1.75mm. Prominent parting in a few grains. Weakly pleochroic in yellow to red-brown.
1% Accessories	Epidote, hematite, magnetite, chlorite, muscovite.

SPECIMEN CL 21 E - QUARTZ DIORITE

Location	4000 feet N.15°E. of the S.W. corner of the quadrangle. 1800 feet S.21 E. of Bennett Cemetery.
Megascopic	Medium-to coarse-grained light-gray quartz-biotite-feldspar quartz diorite. Highly sheared, weathers yellowish-brown.
Thin Section	Grains of quartz average 1.0mm, biotite average 1.25mm, plagioclase 1.75mm, and microcline 0.75mm. The orientation of biotite gives evidence of shearing. All the plagioclase is sericitized. Myrmekite is present as the largest grains of plagioclase, 2.5mm.
Composition	
45% Andesine	Grains 0.5mm and smaller show weak zoning and are anhedral. Anhedral grains ranging from 0.5mm to 2.5mm are not zoned but have well developed albite twinning. Traces of sericite present.
25% Quartz	Anhedral grains range from 3.5mm to 0.75mm. Moderate strain is evidenced by wavy extinction.
17% Microcline	Grains average 0.75mm but range from 1.00mm to 0.25 mm and appear anhedral. Tartan twinning is moderately developed in some grains.
10% Biotite	Euhedral to subhedral grains range from 0.5mm to 2.0mm. Orientation of subhedral grains best exemplifies shearing.
2% Epidote	Grains are 0.1mm or less and are subhedral to anhedral. Closely associated with biotite.
1% Accessories	Sphene, muscovite.

SPECIMEN CL 22 A - QUARTZ DIORITE

Location	4800 feet N.24°E. of the S.W. corner of the quadrangle at elevation 555 to 560 feet.
Megascopic	Medium-to coarse-grained medium-gray biotite-feldspar-quartz-hornblende quartz diorite. Rock weathers yellow. Very weak foliation shown by alternating layers rich in biotite and feldspar.
Thin Section	Epidote is 2 to 3%, most of which is present as alteration product of plagioclase. Average grain of quartz is 0.25mm; microcline, 1.0mm; plagioclase, 1.75mm; biotite, 0.75mm; hornblende, 1.0mm. Most grains are anhedral. Plagioclase appears blocky.
Composition	
35% Andesine	Pericline, albite, Carlsbad twins well developed. Inclusions of quartz present in the form of myrmekite. Subhedral to anhedral. Grains range from 0.5mm to 3.0mm. Epidote is strongly developed here as a form of hydrothermal alteration. Strain effects shown by bent twin lamellae. Some grains are twinned and zoned.
24% Microcline	Anhedral grains ranging from 0.25mm to 1.75mm. Polysynthetic twinning is weakly developed. Weak undulose extinction has developed in a few grains.
20% Quartz	Strong undulose extinction. 1% of quartz is inclusions. Grains are anhedral. Size ranges from 0.1mm to 0.5mm.
12% Biotite	Subhedral to anhedral grains range from 0.25mm to 1.0mm. Pleochroic haloes have been developed around inclusions of zircon. Yellowish-brown to olive green pleochroism.
8% Hornblende	A few pleochroic haloes in a minority of the grains. Grains range from 0.5mm to 2.0mm but most is 0.5mm to 1.0mm, anhedral. Pleochroic in pale green to dark bluish-green.
1% Accessories	Epidote, apatite, zircon, allanite, chlorite, sphene.

SPECIMEN CL 22 C - SCHISTOSE GNEISS

Location	6000 feet N.26°E. of the S.W. corner of the quadrangle. Elevation is 495 to 500 feet.
Megascopic	Fine-grained medium-gray quartz-biotite-feldspar schistose gneiss that has been intruded by sills of quartz diorite. Gneiss has a "salt and pepper" appearance. Rock weathers yellow.
Thin Section	Average grain size of biotite is 0.25mm; plagioclase, 0.5mm; quartz, 0.4mm. Nearly all grains are anhedral. Quartz diorite is not well represented so the following composition is for gneiss only. Weak lineation. Rock weathers yellowish-brown.
Composition	
50% Andesine(An_{35})	Anhedral grains ranging from 0.25mm to 0.75mm. Extinction angle of 17 degrees and positive biaxial figure. Albite, Carlsbad, and pericline twins well developed. Some grains are zoned with 2 to 3 zones.
35% Quartz	None to very weak undulose extinction shows minimal strain effects. Grains range from 0.1mm to 0.75mm. All are anhedral.
13% Biotite	Most grains are subhedral but some are anhedral. Size ranges from 0.1mm to 0.5mm. Pleochroic in yellowish-green to dark olive green. Near parallel extinction birdseye effect is seen in many grains.
1% Epidote	Grains are less than 0.1mm, subhedral to anhedral. Occurence closely associated with plagioclase and is found surrounding allanite.
1% Accessories	Allanite, sphene, muscovite, spinel.

SPECIMEN CL 23 A - QUARTZ DIORITE

Location	6800 feet N.19.5°E. of the S.W. corner of the quadrangle at elevation 540 feet.
Megascopic	Fine to medium-grained plagioclase-potassium feldspar-quartz-biotite-sphene quartz diorite. Rock weathers brown.
Thin Section	Sericite on plagioclase and along grain boundaries. Epidote primarily with plagioclase as hydrothermal alteration product. Average grain size of biotite is 0.75mm; hornblende, 0.75mm; plagioclase, 1.25mm; quartz, 0.5mm; potassium feldspar, 0.75mm. Biotite grains indicate weak lineation.
Composition	
40% Oligoclase-Andesine	Subhedral to anhedral grains range from 0.25mm to 4.5mm. Most are 0.75mm to 1.50mm. Carlsbad, albite, and percline twins are well developed. Anhedral quartz inclusions of 0.1mm, or less, in some grains.
25% Microcline	Grains range from 0.25mm to 1.0mm and are anhedral. Twinning is poor and may be absent.
20% Quartz	Anhedral grains ranging from 0.25mm to 0.5mm. Undulose extinction is present in some grains.
8% Hornblende	Grain size ranges from 0.25mm to 2.0mm. Most are 0.25mm to 0.75mm. Grains are subhedral to anhedral. Pleochroic in yellowish-green to dark green. Most grains are parallel to (101). Radiohaloes moderately developed.
5% Biotite	Subhedral to anhedral grains show characteristic birdseye extinction. Sizes range from 0.25mm to 1.0mm. Pleochroic in reddish-olive green to yellowish-green. Some radiohales that surround zircon inclusions are present.
2% Accessories	Epidote, sphene, allanite(euhedral.to subhedral), apatite.

SPECIMEN CL 24 B - QUARTZ DIORITE

Location	7800 feet N.17°E. of the S.W. corner of the quadrangle on the 570 feet contour.
Megascopic	Medium-to coarse-grained gray quartz-plagioclase-potassium feldspar-biotite-epidote-sphene porphyritic quartz diorite. Epidote and sphene are 1 to 2% of total. Phenocrysts of feldspar are 15% of rock.
Thin Section	Plagioclase is well twinned and sericite is weakly developed on these grains. Myrmekite as large as 0.75mm. Average grain size of plagioclase is 2.0mm; biotite, 1.0mm; quartz, 1.5mm; potassium feldspar, 2.25mm; epidote, 0.1mm. Most grains are anhedral.
Composition	
39% Plagioclase	Anhedral grains ranging from 0.75mm to 3.25mm. Albite, Carlsbad, and Pericline twinning. Myrmekite is 2% of plagioclase present. Sericite is fine grained.
24% Microcline	Anhedral inclusions of quartz range from 0.25mm to 0.5mm and are present in just a few grains. Polysynthetic twinning is very weakly developed or not present. Anhedral grains range from 0.75mm to 3.75mm.
18% Biotite	Epidote and sphene are closely associated with biotite. Grains range from 0.25mm to 2.0mm and are anhedral. Yellowish green to olive green pleochroism.
15% Quartz	Anhedral grains ranging from 0.5mm to 2.25mm. Undulose extinction is very weakly developed and is not present is some grains.
2% Epidote	Grains are 0.25mm to 0.1mm and less. Subhedral to anhedral for most. A few euhedral cross sections.
2% Accessories	Sphene, apatite, hornblende, hematite.

SPECIMEN CL 25 C - SCHISTOSE GNEISS INTRUDED BY QUARTZ DIORITE

Location	7900 feet N.18°E. of the S.W. corner of the quadrangle at elevation 535 feet.
Megascopic	Fine-to medium-grained dark-gray quartz-biotite-plagioclase schistose gneiss that has been intruded by a quartz-biotite-feldspar-muscovite quartz diorite. Both are well represented. Quartz diorite sill is 4.5mm to 9.0mm wide.
Thin Section	Strong lineation shown by biotite. Grains in quartz diorite average 0.75mm and are anhedral. Plagioclase has moderate sericitization in quartz diorite. Grains in schistose gneiss average 0.5mm, subhedral to anhedral. Weak radiohaloes in a few biotite grains of the gneiss.

Composition (Schistose Gneiss)

57% Plagioclase	Anhedral to subhedral grains range from 0.25mm to 0.5mm. Weakly developed albite and Carlsbad twins in some grains. Other grains may be zoned with 2 to 3 zones.
35% Biotite	Subhedral grains that are 0.25mm to 0.75mm. Pleochroic in yellowish-green to olive green. Foliation shown by biotite. Some grains have developed weak radiohaloes around zircon inclusions.
5% Quartz	Anhedral grains averaging 0.25mm. Very weak undulose extinction in some grains.
1% Epidote	Occurs with biotite. Subhedral grains which are 0.05mm to 0.1mm.
2% Accessories	Apatite, allanite, zircon, pyrite.

Composition (Quartz Diorite)

38% Plagioclase	Most are 0.75mm but range from 0.5mm to 1.0mm, anhedral. Albite and pericline twinning moderately developed in some grains. Zoned grains show 2 to 3 zones.

22% Potassium Feldspar	Weak undulose extinction. Anhedral grains are 0.1mm to 0.75mm. (Microcline?)
35% Quartz	Grains range from 0.25mm to 1.25mm. All grains are anhedral. Undulose extinction is not present in all grains.
3% Biotite	Euhedral to subhedral grains. Many grains exhibit birdseye effect. Size ranges from 0.1mm to 0.25mm. Pleochroic in yellowish brown to olive green.
1% Accessories	Muscovite, epidote, chlorite, apatite.

SPECIMEN CL 25 D - QUARTZ DIORITE

Location	8480 feet N.15.9°E. of the S.W. corner of the quadrangle. Elevation 570 to 580 feet.
Megascopic	Coarse-grained gray plagioclase-potassium feldspar-quartz-biotite-sphene porphyritic quartz diorite. 1 to 2% of total composition is sphene and pyrite. Phenocrysts of feldspar are 15% of rock.
Thin Section	Twinning is well developed in plagioclase and microcline. Myrmekite is less than 1% of total plagioclase. Grains are subhedral to anhedral and average 1.0mm.
Composition	
45% Plagioclase	Subhedral to anhedral grains range from 0.75mm to 5.0mm. Most are 1.0mm to 3.0mm. Albite and pericline twinning. Anhedral quartz inclusions ranging from 0.1mm to 0.75mm present in some grains. Myrmekite is less than 1% of plagioclase.
23% Quartz	Grains range from 0.05mm to 2.5mm. Most are 1.0mm to 1.5mm. All are anhedral. Strain effects shown by well developed undulose extinction. 1 to 2% of all quartz is present as inclusions.
15% Microcline	Anhedral grains ranging from 1.0mm to 10.0mm. Polysynthetic twinning noderately well developed. Anhedral quartz inclusions average 0.25mm. Inclusions of anhedral plagioclase range from 0.1mm to 0.75mm and are present in very few grains.
15% Biotite	Subhedral to anhedral grains average 1.5mm. Characteristic birdseye effect occurs near parallel extinction.
2% Accessories	Sphene, epidote, pyrite, hornblende, apatite, ilmenite, hematite.

SPECIMEN CL 27 A - GNEISS

Location	4600 feet N.39°E. of the S.W. corner of the quadrangle at the 510 feet contour.
Megascopic	Fine-to medium-grained light-gray biotite-potassium feldspar-plagioclase-quartz gneiss. Lineation is moderately developed. Rock weathers yellow.
Thin Section	Grains average 0.25mm. Moderately developed sericite on plagioclase grains and along grain boundaries. Subhedral to anhedral grains. Average grain size is 0.50mm.
Composition	
52% Plagioclase	Twinning is very weakly developed. Grains range from 0.1mm to 0.5mm and are anhedral. Sericitization heavy on some grains but moderate on most.
35% Quartz	Grains are anhedral. Moderate strain shown by undulose extinction. Size ranges from 0.25mm to 1.0mm.
8% Microcline	Polysynthetic twinning is well developed. Anhedral grains range from 0.25mm to 0.75mm.
3% Biotite	Subhedral to anhedral grains. Pleochroic in yellowish-brown to olive green. Size range is 0.1mm to 0.25mm.
2% Accessories	Chlorite, muscovite, apatite, sphene.

SPECIMEN CL 27 C - QUARTZ DIORITE

Location	5140 feet N.31°E. of the S.W. corner of the quadrangle at elevation 538 to 540 feet.
Megascopic	Coarse-grained porphyritic gray quartz-biotite-potassium feldspar-plagioclase-epidote quartz diorite. Rock weathers reddish-brown. Felspar phenocrysts range from 5.0mm to 36mm.
Thin Section	Average grain size of biotite is 0.75mm; epidote, 0.25mm; potassium feldspar, 2.5mm; quartz, 1.0mm; plagioclase, 1.25mm. Myrmekite if less than 1% of total slide. Antiperthite contains subhedral poassium feldspar inclusions averaging 0.1mm. Unusually large amount epidote.
Composition	
47% Plagioclase	Subhedral to anhedral grains range from o.5mm to 4.75mm but most are 1.0mm to 1.25mm. Antiperthitic texture present in most grains. Myrmekite is less than 1% of plagioclase. Albite and Carlsbad twinning moderate to well developed.
25% Quartz	Grains range from 0.25mm to 2.0mm but most are 0.75mm. All are anhedral.
15% Microcline	Anhedral grains range from 1.0mm to 3.75mm. Tartan twinning well developed in most grains. Anhedral quartz inclusions are 0.1mm and less.
8% Biotite	Euhedral to subhedral grains range from 0.75mm to 0.5mm.
4% Epidote	Largest grains are 0.25mm but most are 0.1mm or less. Grains are subhedral to anhedral. Closely associated with plagioclase and biotite.
1% Accessories	Chlorite, allanite, pyrite.

SPECIMEN CL 27 D - AMPHIBOLITE

Location	4940 feet N.23.3°E. of the S.W. corner of the quadrangle at elevation 535 to 540 feet.
Megascopic	Fine-to medium-grained dark-gray hornblende-feldspar-sphene amphibolite. Rock weathers dark reddish-brown. Weak foliation present and no or very weak lineation. Hornblende is atleast 80% of total composition.
Thin Section	Average grains of hornblende, 0.25mm; biotite, 0.75mm; plagioclase, 0.3mm; quartz, 0.25mm. Fine grained sericite is weakly developed on plagioclase. Subhedral to anhedral grains.
Composition	
85% Hornblende	Largest grains are 1.0mm. Most range from 0.1mm to 0.25mm. Grains are subhedral to anhedral. Pleochroic in dark bluish-green to pale yellowish-green. Grains are parallel to (010).
10% Plagioclase	Anhedral grains range from 0.1mm to 0.5mm. Well developed pericline and albite twinning or zoning is present. Largest grain is 1.75mm, anhedral, and has albite twinning.
3% Biotite	Most grains are 0.25mm to 1.0mm but may be as large as 2.0mm. Epidote is closely associated with biotite. Grains are subhedral to anhedral. Pleochroic in yellowish-brown to green
1% Quartz	Grains average 0.25mm. All are anhedral. Very weak undulose extinction.
1% Accessories	Sphene, epidote, apatite, potassium feldspar, hematite.

SPECIMEN CL 28 A - GNEISS

Location	3800 feet N.55°E. of the S.W. corner of the quadrangle at the 500 feet contour. Outcrop is 340 feet long and ranges in elevation from 495 to 505 feet.
Megascopic	Fine-to coarse-grained dark-green biotite-hornblende-plagioclase gneiss. Rock weathers reddish-brown. Hornblende is at least 75% of the total composition. Well foliated and banded.
Thin Section	Average grain size of hornblende is 2.25mm; scapolite, 1.5mm; plagioclase, 1.0mm; biotite, 0.5mm. Plagioclase is extremely anhedral. Epidote closely associated with plagioclase. Grains are anhedral.
Composition	
80% Hornblende	Pleochroic in pale green to dark bluish-green. Anhedral grains ranging from 0.25mm to 4.5mm but most are 2.0mm to 2.5mm. Sections are parallel to (010).
10% Scapolite	Very anhedral grains that range from 0.5mm to 2.5mm. Interference colors to blue of second order indicates a moderately high calcium content.
5% Plagioclase	Anhedral grains range from greater than 0.1mm to 1.25mm and have well developed albite and Carlsbad twins. Grains measuring less than 0.1mm are zoned with 2 to 4 zones and are subhedral. Epidote is closely associated with plagioclase grains.
4% Biotite	Anhedral grains averaging 0.5mm. Yellowish-brown to dark olive green pleochroism. Near parallel extinction birdseye effect is seen.
1% Accessories	Epidote, quartz, sphene, hematite, ilmenite, chlorite.

SPECIMEN CL 28 C - QUARTZ DIORITE

Location	3800 feet N.55°E. of the S.W. corner of the quadrangle. Towards N. end of outcrop.
Megascopic	Medium-to coarse-grained medium-gray plagioclase-potassium feldspar-biotite-quartz quartz diorite. Foliation is weakly developed. Rock weathers yellow.
Thin Section	Weak sericitization on plagioclase grains. Grains average 1.0mm, subhedral to anhedral. Strain effects shown by bent lamellae in plagioclase and strong undulose extinction of quartz. Plagioclase is blocky.
Composition	
53% Plagioclase	Anhedral grains ranging from 0.5mm to 3.0mm. Well developed twins of albite, Carlsbad, and pericline. Sericite is fine grained.
17% Quartz	Moderate to strong undulose extinction. Size ranges from 1.0mm to 2.5mm, anhedral.
15% Microcline	Grains are very poorly twinned. Sharp to slighty wavy extinction. Size ranges from 0.5mm to 2.0mm. All are anhedral.
12% Biotite	Subhedral to anhedral. Grains are 0.25mm to 1.75mm. Most are between 0.5mm to 1.0mm. Pleochroic haloes have developed around zircon inclusions. A very few apatite inclusions are also present.
2% Muscovite	Grains average 1.0mm but range from 0.25mm to 1.5mm. Many grains are subhedral while some are anhedral. Occurence closely associated with biotite.
1% Accessories	Chlorite, sphene, pyrite, epidote, allanite.

SPECIMEN CL 29 A - QUARTZ DIORITE

Location	9900 feet N.9°E. of the S.W. corner of the quadrangle. Elevation is 640 to 645 feet.
Megascopic	Medium-to coarse-grained light-gray porphyritic quartz diorite. Lineation is moderately developed and is shown by phenocrysts and lenticular quartz. Rock weathers yellowish-brown.
Thin Section	Sericite is moderately developed on plagioclase and along grain boundaries. Average grains of biotite are 0.75mm; quartz, 1.0mm; plagioclase, 0.5mm; microcline, 0.1mm. Grains are euhedral to anhedral. Felspar phenocrysts are 15%.
Composition	
38% Plagioclase	Anhedral grains measuring 0.1mm, and less, are zoned. Twinning is weakly developed in grains ranging from greater than 0.1mm to 1.0mm. Moderate development of sericite on grains and between grains boundaries.
20% Microcline	Most grains are 0.1mm and anhedral. Polysynthetic twinning is weakly developed and is not present in all grains.
35% Quartz	Grains range from 0.25mm to 1.75mm. All are anhedral. Undulose extinction is evidence of strain. Approximately 2% of total quartz present is anhedral inclusions in plagioclase.
5% Biotite	Grains are euhedral to anhedral and range from 0.25mm to 1.25mm. Pleochroic in yellowish-brown to olive green.
2% Accessories	Epidote, sphene, apatite, allanite.

SPECIMEN CL 30 A - QUARTZ DIORITE

Location	9240 feet N.14.5°E. of the S.W. corner of the quadrangle. On the 620 feet contour.
Megascopic	Medium- to coarse-grained light-gray quartz-biotite-plagioclase-potassium feldspar quartz diorite. Rock weathers orangish-brown. Lineation suggested by biotite.
Thin Section	Lineation is moderately developed. Grains of andesine average 2.5mm;quartz, 1.0mm; biotite, 1.25mm; microcline, 1.5mm. Subhedral to anhedral. Unusually large amount of sphene that occurs closely with biotite.
Composition	
43% Andesine	Anhedral grains ranging from 0.25mm to 5.0mm. Most are 2.5mm. Grains measuring 0.25mm may show 3 to 4 zones. Moderately developed Calrsbad, albite twins. Pericline twinning in a few grains. Anhedral quartz inclusions are 0.25mm or less.
26% Quartz	Most are 0.75mm to 2.0mm but range from 0.25mm to 3.0mm. All are anhedral.
15% Biotite	Epidote and sphene closely associated with biotite. A few scattered zircon inclusions. Subhedral to anhedral grains range from 0.25mm to 2.0mm. Most are 1.25mm.
13% Microcline	Polysynthetic twinning is very poorly developed. Anhedral grains ranging from 0.5mm to 2.75mm.
2% Sphene	Subhedral to anhedral grains. Sizes are 0.1mm to 0.75mm. Prominent parting in a few grains.
1% Accessories	Ilmenite, magnetite, muscovite, apatite, epidote, zircon.

SPECIMEN CL 30 C - QUARTZ DIORITE

Location	7860 feet N.20°E. of the S.W. corner of the quadrangle on the 540 feet contour.
Megascopic	Medium-to fine-grained medium-gray sheared biotite-feldspar-quartz-muscovite-quartz diorite. Rock weathers yellowish-brown. Shear fold indicated by biotite orientation.
Thin Section	Average grain is 0.5mm. Plagioclase shows sparse covering of sericite. Majority of grains are anhedral. Grains of quartz show strong undulose extinction.
Composition	
42% Andesine	Grains range from 0.25mm to 0.75mm. Most subhedral grains display weak albite twinning whereas most anhedral grains are zoned with 2 to 4 zones.
25% Potassium Feldspar	Anhedral grains ranging from 0.25mm to 0.5mm. Strain effects are shown by wavy extinction in some grains. Grains show no twinning.
20% Quartz	Grains are anhedral and range from o.25mm to 1.0mm. Strong wavy extinction.
10% Biotite	Most grains are between 0.75mm and 1.0mm but range from 0.25mm to 1.25mm. Majority are subhedral. Characteristic birdseye extinction. Orientation of grains shows direction of shearing.
2% Muscovite	Subhedral to anhedral grains ranging from 0.25mm to 1.0mm.
1% Accessories	Epidote, allanite, sphene.

SPECIMEN CL 30 E - PEGMATITE

Location	7540 feet N.23°E. of the S.W. corner of the quadrangle at elevation 520 feet.
Megascopic	Medium-to very-coarse-grained white quartz-potassium feldspar-chlorite-sphene pegmatite. Rock weathers yellow. Quartz is smokey brown.
Thin Section	Average grain size of potassium feldspar is 2.5mm; quartz, 1.25mm; chlorite, 0.75mm; muscovite, 0.5mm. Weak sericitization on feldspar. Fractures present contain predominantly quartz. Grains are euhedral to anhedral.
Composition	
67% Microcline	Anhedral grains ranging from 0.3mm to 6.0mm. Most are 2.5mm to 2.0mm. Polysynthetic twinning is very strongly developed. Anhedral quartz inclusions of 0.1mm or less form graphic granite.
23% Quartz	Wavy extinction is weakly developed. Grains range from 2.5mm to 0.75mm and are anhedral. Majority of mineral in fractures.
7% Plagioclase	Grains are anhedral and range from 0.75mm to 0.5mm. Slightly cloudy as compared to quartz. Carlsbad twinning present.
2% Chlorite	Anomalous "Berlin blue" interference color indicates this variety is penninite(pennine). Grains range from 2.5mm to 0.25mm but most are 0.75mm to 0.25mm. Euhedral to subhedral grains.
1% Accessories	Muscovite, allanite, epidote, plagioclase, sphene.

SPECIMEN CL 31 B - BANDED GNEISS

Location	10000 feet N.16.2°E. of the S.W. corner of the quadrangle at elevation 640 feet.
Megascopic	Fine-to medium-grained light-gray plagioclase-biotite-quartz banded gneiss. Bands are alternating layers rich in feldspar and biotite. A few moderately developed fractures. Rock weathers yellow to yellowish-brown.
Thin Section	Development of weak lineation and moderate foliation is shown by biotite. Majority of grains are anhedral and average 0.5mm. Sericite very weakly developed on plagioclase and along grain boundaries.
Composition	
57% Plagioclase	Anhedral grains ranging from 0.1mm to 0.75mm. Albite, pericline, Carlsbad twins are well developed in most grains. Overall appearance is blocky.
35% Quartz	Undulose extinction is moderately developed. Grains are 0.75mm to 0.1mm and less. All are anhedral.
7% Biotite	Subhedral to anhedral grains range from 0.1mm to 0.75mm. Sphene occurs closely with biotite. A few pleochroic haloes are moderately developed. Pleochroic in yellowish-brown to brownish-olive green.
1% Accessories	Allanite, epidote, muscovite, sphene, apatite.

Percentages of Major Mineral Constituents

PONAGANSET GNEISS

Specimen	Plagioclase	Potassium Feldspar	Quartz	Biotite	Hornblende	Minor Mineral Constituents
Cl 16 A	35	30	25	8	-	2
CL 16 C	48	18	27	5	-	2
CL 16 D	25	10	30	30	-	5
CL 17 B	44	20	30	5	-	1
CL 18 A	44	15	10	15	-	1
CL 19 A (Quartz diorite only)	46	25	20	5	-	4
CL 19 B	48	20	17	10	-	5
CL 20 E	39	16	35	7	-	3
CL 21 E	45	17	25	10	-	3
CL 22 A	35	24	20	12	8	1
CL 23 A	40	25	20	5	8	2
CL 24 B	39	24	15	18	-	4
CL 25 C (Quartz diorite only)	38	22	35	3	-	1
CL 25 D	45	15	25	15	-	2
CL 27 C	47	15	25	8	-	5
CL 28 C	53	15	17	12	-	3
CL 29 A	38	20	35	5	-	2
CL 30 A	43	13	26	15	-	3
CL 30 C	42	25	20	10	-	3
CL 30 E	7	67	23	--	-	3

METAVOLCANICS AND METASEDIMENTS

Specimen	Plagioclase	Potassium Feldspar	Biotite	Quartz	Hornblende	Minor Mineral Constituents
CL 16 B	60	-	13	25	-	2
CL 17 C	59	5	20	12	-	1
CL 18 B	60	-	33	5	-	2
CL 19 A (Gneiss only)	58	-	11	26	-	6
CL 20 C	61	-	18	15	-	5
CL 22 C	50	-	13	35	-	2
CL 25 C (Gneiss only)	57	-	35	5	-	2
CL 27 A	52	-	3	35	-	2
CL 27 D	10	-	3	1	85	1
CL 28 A	5	-	4	-	80	11 (10% Scapolite)
CL 31 B	57	-	7	35	-	1

REFERENCES CITED

Harwood,D.S., and Goldsmith, Richard,1971, Bedrock geologic map of the Oneco quadrangle, Connecticut and Rhode Island: U.S. Geol. Survey Geol. Quad. Map GQ-930. (In press)

Moore, G.E., Jr., 1963, Bedrock geology of the Coventry Center quadrangle, Rhode Island: U.S. Geol. Survey Bull. 1158-A, 24p.

Quinn, A.W.,1967, Bedrock Geology of the Chepachet quadrangle, Providence County, Rhode Island: U.S. Geol. Survey Bull. 1158-B, p. 16.

Quinn, A.W., 1971, Bedrock Geology of Rhode Island: U.S. Geological Survey Bull. 1295, p. 9,14,15,24,25,26,30,31.

EXPLANATION

sgf

FINE GRAINED GRANITE
related to Scituate Granite Gneiss and Ten Rod Granite Gneiss. Light-gray, light-pink, and light-tan, fine-grained granite, locally porphyritic, some massive, commonly with lineation of biotite flakes; main constituents are microcline, microperthite, albite. quartz, and biotite

sg

SCITUATE GRANITE GNEISS
Pinkish-gray, light-tan, and gray, medium-to coarse-grained granite gneiss; strong lineation of oval splotches of biotite, foliated in places; composed chiefly of microcline, microperthite, albite-oligoclase, quartz, and biotite, locally hornblende and magnetite.

pgn

PONAGANSET GNEISS
Light-to dark-gray, medium-to coarse-grained, locally porphyroblastic, strongly foliated and lineated variable group of gneissic rocks. Composed in varying proportions of microcline, plagioclase varying from An_{11} to An_{35}, quartz, biotite, hornblende, and muscovite

mv

METAVOLCANIC ROCKS
Light-and dark-gray, fine grained, interlayered feldspathic gneiss, schist, quartzite, amphibolite, and lime-silicate rock; composed chiefly of feldspars, muscovite, biotite, quartz, and amphibole; locally staurolite and sillimanite

Paleozoic

Only outcrops that specifically apply to this report are shown on the map.

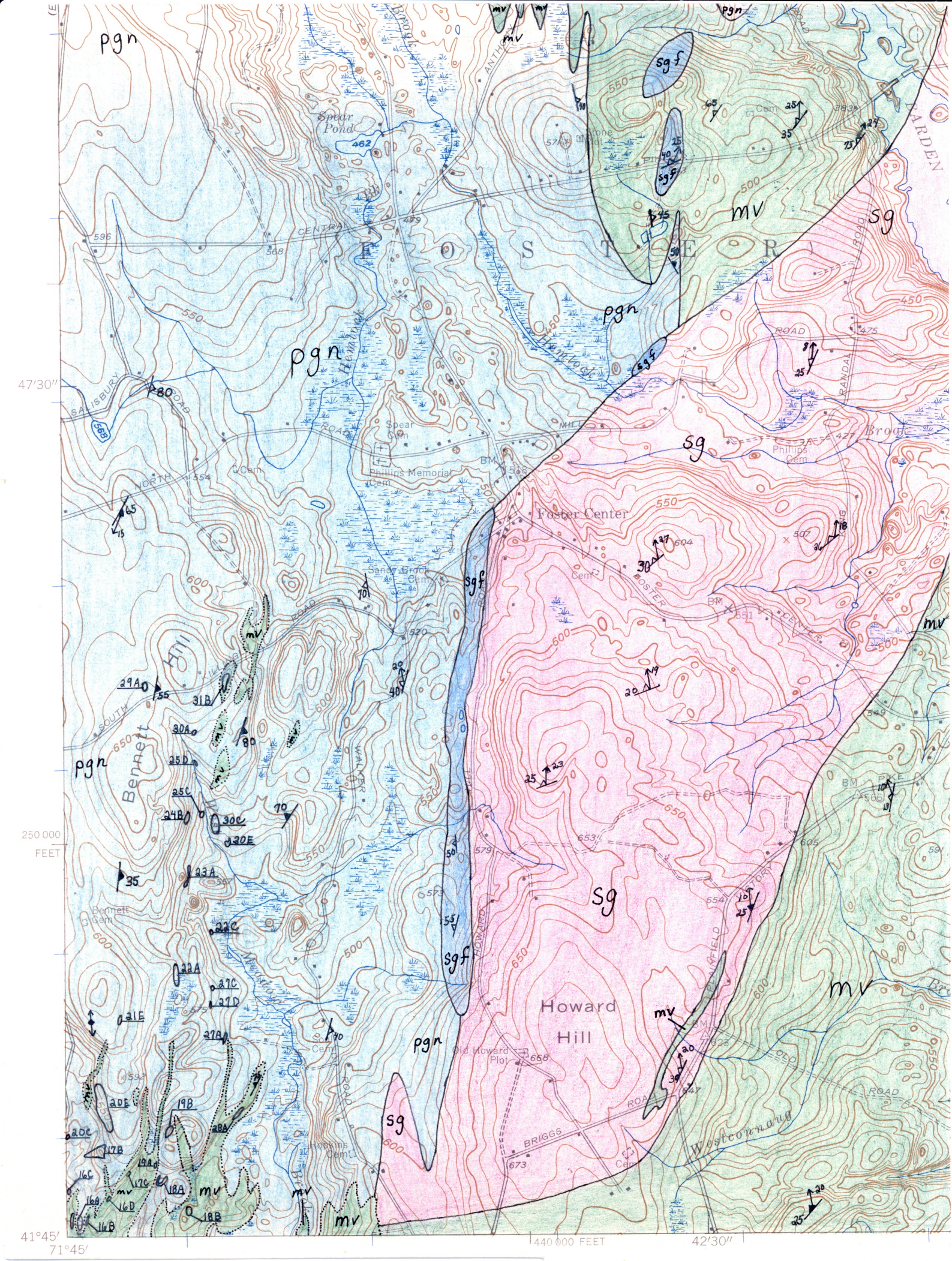
The "CI" has been omitted from the specimen identification number on the map only.

Contact
Solid where believed accurate; dashed where approximate; dotted where concealed.

40
Strike and dip of foliation.

Strike of vertical foliation

20
Bearing and plung of lineation


pgn
sgf
mv
sg
Spear Pond
Foster Center
Howard Hill
Old Howard Plot
Phillips Memorial Cem
Spear Cem
Sandy Brook Cem
Bennett Cem
Hopkins Cem
Phillips Cem
Foster Cem
Bennett Hill
Westcommang
Broad
Pascoag
Hemlock
Wallum
Stillwater
Branch
Anthony
Central
Salisbury
North
South
Howard
Briggs
Old Howard
Randall
Foster
Center
Road
Mill
Turnpike
Old Plainfield
Pike
Garden
47'30"
41°45'
71°45'
250 000 FEET
440 000 FEET
42'30"

(ONECO)

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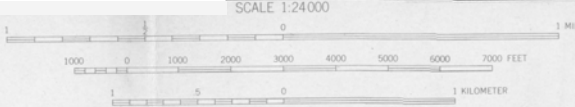
Topography by planetable surveys 1942–1943
Revised 1955

Polyconic projection. 1927 North American datum
10,000-foot grid based on Rhode Island coordinate system
1,000-meter Universal Transverse Mercator grid ticks,
zone 19, shown in blue

APPROXIMATE MEAN
DECLINATION, 1955

SCALE 1:24000



CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty ——— Light-duty ———
Medium-duty ——— Unimproved dirt - - - - - -

U. S. Route State Route

(CROMPTON)

CLAYVILLE, R. I.
N4145—W7137.5/7.5

1955

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST